CLAIMS

1. A microfluidic device comprising:

a substrate having at least one channel and an aperture in fluid communication with said channel;

a cover bonded to said substrate such that a reservoir is formed at said aperture; and

an electrically conducting ink pattern on at least one of said substrate and cover such that when a material is present in said channel and reservoir said ink pattern makes electrical contact with said material.

2. The device of claim 1 wherein said ink pattern is on said cover.

3. The device of claim 1 wherein said electrical contact is made in said reservoir.

4. The device of claim 1 comprising a first channel, a second channel, and a third channel, said first and second channel being fluidly connected to said third channel at separate points along the third channel and wherein said electrical contact is made in one of said first channel, second channel, and third channel.

5. The device of claim 1 wherein the cover is bonded to the substrate by thermal bonding.

6. The device of claim 1 wherein the cover is bonded to the substrate using an adhesive.

7. The device of claim 1 wherein the cover is bonded to the substrate using a double sided adhesive layer.

8. The device of claim 1 wherein the material is a substance useful in electrophoretic applications.

9. The device of claim 1 wherein the ink pattern is on said substrate.

10. The device of claim 1 wherein said ink is patterned on said cover using ink jet printing.

11. The device of claim 1 wherein said ink is patterned on said cover using screen printing.

12. The device of claim 1 wherein said ink is patterned on said cover through lithography.

13. The device of claim 1 wherein said cover is a thin film.

15. The device of claim 1 wherein said cover is made of PMMA.

16. The device of claim 1 wherein said ink is one ink selected from the group consisting of polyester or acrylic-based carbon/graphite ink, platinum ink, silver ink, silver/silver chloride ink, and metal powder doped carbon ink.

17. The device of claim 1 wherein said ink is a polyester based silver/silver chloride ink.

18. The device of claim 1 wherein said ink has width of 10 to 400 μm.

19. The device of claim 1 wherein said ink pattern includes a contact, a lead, and a heating element.

20. The device of claim 19 wherein said heating element supplies heat and senses temperature.

21. The device of claim 20 wherein said ink has thickness of 5 to 100 μm.

22. The device of claim 1 wherein said substrate is made from a plastic selected from the group comprising norbornene, polystyrene, acrylic, polycarbonate-polyester, and polyolefin.

23. The device of claim 1 wherein said substrate is a norbornene based substrate.

24. The device of claim 1 wherein said ink is in a solid state.

25. The device of claim 1 wherein said ink is in a semi-fluidic state.

26. A method for reducing bubble formation during electrokinetic applications in a microfluidic device having interconnected channels and reservoirs, said method comprising the steps of:

applying voltage to a medium contained in said channels and reservoirs, said voltage being applied to said medium through an electrically conducting ink in electrical contact with said medium wherein said electrically conducting ink reduces bubble formation during application of said voltage to said medium.

27. The method of claim 26 wherein said microfluidic device comprises a substrate and a cover bonded to said substrate and wherein said electrically conducting ink is patterned on said cover such that when said cover is bonded to said substrate to form said device said ink is positioned in said reservoir and makes electrical contact with said medium therein.

28. The method of claim 26 wherein an electrode is positioned in one of said reservoirs to make electrical contact with said medium in said reservoirs and wherein said electrode comprises a coating of said electrically conducting ink.

29. The method of claim 26 wherein the ink is selected from the group consisting of polyester or acrylic-based carbon/graphite ink, platinum ink, silver ink, silver/silver chloride ink, and metal powder doped carbon ink.

30. The method of claim 26 wherein the ink comprises silver/silver chloride.

31. A method of heating material contained in channels of a microfluidic device comprising:

applying a voltage to at least one electrically conductive ink trace patterned on a component of said microfluidic device wherein said application of voltage to said ink trace heats said material.

32. The method of claim 31 wherein the ink trace is serpentine shaped.

33. The method of claim 31 wherein said ink trace contacts said material to be heated.

34. The method of claim 31 wherein said ink trace does not contact said material to be heated.

35. The method of claim 33 wherein said ink comprises a thermally sensitive polymer.

36. The method of claim 33 wherein said ink comprises hydrogel.

37. The method of claim 35 further comprising the step of controlling the temperature of said ink such that flow of material through said channels is controlled.

38. The method of claim 31 wherein said application of voltage is cyclic.

39. The method of claim 31 further comprising measuring a resistance of the trace and using said measured resistance to determine a temperature of the trace.

40. The method of claim 31 wherein said component is a substrate having said channel.

41. The method of claim 31 wherein said component is a cover bonded to a substrate having said channel.

42. A method for measuring material in a microfluidic device having a substrate and a cover bonded to said substrate, said method comprising:

applying a current to an ink trace patterned on said cover; and

measuring an electrical property resulting from said step of applying a current to said ink trace to determine the presence of a material to be detected.

43. The method of claim 42 wherein said ink trace includes a catalyst reactive to said material to be measured.

44. The method of claim 43 wherein the electrical property is current.

45. A method for fabricating a microfluidic device having integrated electrodes comprising:

applying an electrically conducting ink pattern to a plastic film;

bonding said film to a plastic substrate having interconnected channels such that said ink pattern makes electrical contact with material contained in the interconnected channels when the material is present in said channels.